HIGHLIGHTS

of the **2023 American Heart Association Focused Update on Adult Advanced Cardiovascular Life Support**: An Update to the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Heart and Stroke Foundation of Canada Edition

The American Heart Association thanks the following people for their contributions to the development of this publication: Sarah M. Perman, MD, MSCE; Jonathan Elmer, MD, MS; Carolina B. Maciel, MD, MSCR; Anezi Uzendu, MD; Teresa May, DO; Bryn E. Mumma, MD, MAS; Jason A. Bartos, MD, PhD; Amber J. Rodriguez, PhD; Michael C. Kurz, MD, MS; Ashish R. Panchal, MD, PhD; Jon C. Rittenberger, MD, MS; the AHA Adult Life Support Focused Update Writing Group; and the AHA Guidelines Focused Updates Highlights Project Team.

Heart & Stroke is the guidelines-setting body for Canada. It is one of the founding members of the International Liaison Committee on Resuscitation (ILCOR), which reviews evidence and science relating to resuscitation. Heart & Stroke's job, as a member of ILCOR, is to bring together and support Canadian subject matter experts who join experts from around the globe in this review process. ILCOR's consensus on science culminates in recommendations published by member-organizations that guide resuscitation practice and training. In the spirit of collaboration, the AHA and Heart & Stroke work together to ensure resuscitation guidelines are applicable to the Canadian audience.

Introduction

Cardiac arrest is common and deadly, affecting up to 750,000 people in the United States and Canada annually. Advanced cardiovascular life support (ACLS) measures are commonly employed to improve outcomes. These Highlights summarize the key changes and issues in the "2023 American Heart Association Focused Update on Adult Advanced Cardiovascular Life Support," which revises the *2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care*. They are based on the expert writing group review of the relevant International Liaison Committee on Resuscitation *International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations* documents and the studies included in the systematic reviews as well as new evidence updates conducted by the writing group. The writing group discussion and evidence reviews were conducted within the context of the clinical environments in which out-of-hospital and in-hospital resuscitations occur, with special consideration for the health care professionals who use these ACLS guidelines.

Process Overview for Developing Guidelines Focused Updates

In developing these guidelines, the writing group produced clinical questions in the population, intervention, comparison, outcome format; performed structured literature reviews; synthesized the evidence; and developed treatment recommendations by using standardized methodology. Each recommendation was assigned a Class of Recommendation and Level of Evidence using standard American Heart Association definitions (Table). Conflicts of interest of the writing group members were disclosed and managed by using American Heart Association processes.

Table. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care (Updated May 2019)*

CLASS (STRENGTH) OF RECOMMENDATION	LEVEL (QUALITY) OF EVIDENCE‡
CLASS 1 (STRONG) — **Benefit >>> Risk** **Suggested phrases for writing recommendations:** • Is recommended • Is indicated/useful/effective/beneficial • Should be performed/administered/other • Comparative-Effectiveness Phrases†: – Treatment/strategy A is recommended/indicated in preference to treatment B – Treatment A should be chosen over treatment B	**LEVEL A** • High-quality evidence‡ from more than 1 RCT • Meta-analyses of high-quality RCTs • One or more RCTs corroborated by high-quality registry studies
CLASS 2a (MODERATE) — **Benefit >> Risk** **Suggested phrases for writing recommendations:** • Is reasonable • Can be useful/effective/beneficial • Comparative-Effectiveness Phrases†: – Treatment/strategy A is probably recommended/indicated in preference to treatment B – It is reasonable to choose treatment A over treatment B	**LEVEL B-R (Randomized)** • Moderate-quality evidence‡ from 1 or more RCTs • Meta-analyses of moderate-quality RCTs
CLASS 2b (WEAK) — **Benefit ≥ Risk** **Suggested phrases for writing recommendations:** • May/might be reasonable • May/might be considered • Usefulness/effectiveness is unknown/unclear/uncertain or not well-established	**LEVEL B-NR (Nonrandomized)** • Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies • Meta-analyses of such studies
CLASS 3: No Benefit (MODERATE) (Generally, LOE A or B use only) — **Benefit = Risk** **Suggested phrases for writing recommendations:** • Is not recommended • Is not indicated/useful/effective/beneficial • Should not be performed/administered/other	**LEVEL C-LD (Limited Data)** • Randomized or nonrandomized observational or registry studies with limitations of design or execution • Meta-analyses of such studies • Physiological or mechanistic studies in human subjects
CLASS 3: Harm (STRONG) — **Risk > Benefit** **Suggested phrases for writing recommendations:** • Potentially harmful • Causes harm • Associated with excess morbidity/mortality • Should not be performed/administered/other	**LEVEL C-EO (Expert Opinion)** • Consensus of expert opinion based on clinical experience

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

† For comparative-effectiveness recommendations (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely-used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

Updated Recommendations

The 2023 focused update on ACLS includes 6 new or updated recommendations.

Extracorporeal Cardiopulmonary Oxygenation

2023 (Updated): Use of extracorporeal cardiopulmonary resuscitation (ECPR) for patients with cardiac arrest refractory to standard ACLS is reasonable in select patients when provided within an appropriately trained and equipped system of care.

2020 (Old): There is insufficient evidence to recommend the routine use of ECPR for patients with cardiac arrest. ECPR may be considered for select cardiac arrest patients for whom the suspected cause of the cardiac arrest is potentially reversible during a limited period of mechanical cardiorespiratory support.

Why: Since the 2020 guidelines, 2 randomized controlled trials have been published comparing patients with refractory cardiac arrest treated with ongoing standard ACLS vs ECPR.[1,2] The Advanced Reperfusion Strategies for Refractory Cardiac Arrest Trial demonstrated improved survival to discharge (43% vs 7%) and 6-month survival with neurologically favorable outcome (43% vs 0%) in patients receiving ECPR for refractory cardiac arrest with shockable presenting rhythms. The Hyperinvasive Trial demonstrated benefit in 30-day survival with favorable cardiac recovery in the intervention group (31% vs 18.2%). We acknowledge that these trials occurred in very experienced extracorporeal membrane oxygenation centers and may not be generalizable to all communities.

Coronary Angiography After Cardiac Arrest

2023 (Updated): Emergent coronary angiography is not recommended over a delayed or selective strategy in patients with return of spontaneous circulation after cardiac arrest unless they exhibit ST-segment elevation myocardial infarction, shock, electrical instability, signs of significant myocardial damage, or ongoing ischemia.

2020 (Old): Emergent coronary angiography is reasonable for select (eg, electrically or hemodynamically unstable) adult patients who are comatose after out-of-hospital cardiac arrest of suspected cardiac origin but without ST-segment elevation on electrocardiogram.

Why: Since the 2020 guidelines, 4 new randomized controlled trials have been published.[3-6] These trials consistently found no difference between the intervention (emergent or early coronary angiography) and control arms. However, important patient populations were excluded from these clinical trials. Patients with ST-segment elevation, cardiogenic shock, signs of significant myocardial damage, electrical instability, and ongoing ischemia were excluded or permitted to cross over to the emergent arm. Given the paucity of cardiac arrest–specific data and the clear benefits of emergent revascularization in non–cardiac arrest patients with ST-segment elevation myocardial infarction, high-risk acute coronary syndrome patients, and cardiogenic shock patients, we recommend considering emergent coronary angiography and revascularization in these patient populations.

Temperature Control After Cardiac Arrest

2023 (Updated): We recommend selecting and maintaining a constant temperature between 32°C and 37.5°C during postarrest temperature control.

2020 (Old): We recommend selecting and maintaining a constant temperature between 32°C and 36°C during targeted temperature management.

Why: The Targeted Temperature Management 2 Trial found no difference in the primary outcome of Cerebral Performance Category of 1 or 2 at 6 months in patients randomized to 33°C or normothermia with early treatment of fever (37.5°C) for 28 hours after randomization.[7] At present, managing a constant temperature between 32°C and 37.5°C is a reasonable strategy. There continues to be consensus that it is unclear the ideal temperature for special populations that were not represented in the Targeted Temperature Management 2 Trial. For example, patients with arrest of noncardiac etiology or deeper coma may be more likely to benefit from a lower temperature goal. We also note a shift in terminology to *temperature control* rather than *targeted temperature management*.

Seizure Management

2023 (New): A therapeutic trial of a nonsedating antiseizure medication may be reasonable in adult survivors of cardiac arrest with electroencephalography patterns on the ictal-interictal continuum.

Why: While occurrence of postanoxic status epilepticus has been associated with a poor outcome in observational studies, reports of survival with functional independence in some subgroups have accumulated over the past decade. Despite the lack of high-level evidence, untreated clinically apparent seizure activity is thought to be potentially harmful to the brain; therefore, treatment of seizures is recommended in other settings of brain injury and is prudent after cardiac arrest.[8] This recommendation acknowledges one limitation in the existing literature is the heterogeneity in the definition of *status epilepticus*. The 2023 focused update provides criteria for defining seizures to help clinicians standardize definitions.

Organ Donation

2023 (New): Organ donation is an important outcome that should be considered in the development and evaluation of systems of care.

Why: Thousands die annually waiting for organ transplantation. Numerous observational studies demonstrate that allograft function and recipient outcomes are similar when transplanted organs are recovered from cardiac arrest patients compared with other deceased donors.[9-11] Thus, organ donation after cardiac arrest directly benefits recipient patients and is an important outcome that is rarely reported as an outcome in cardiac arrest clinical trials or as a metric in large registry data.

Diversity, Equity, and Inclusion

2023 (New): It is important for researchers to develop and implement methods to improve representation of participants from diverse backgrounds and to improve the accuracy of reporting study subject demographics.

Why: Cardiac arrest prevalence, characteristics, and treatments differ by sex and racial groups.[12-15] These are important covariates that are not consistently reported in the literature and not accounted for in most interventional trials. Further quantification of these disparities as well as elucidation of their underlying causes are critical to developing interventions that will eliminate them.

References

1. Yannopoulos D, Bartos J, Raveendran G, et al. Advanced reperfusion strategies for patients with out-of-hospital cardiac arrest and refractory ventricular fibrillation (ARREST): a phase 2, single centre, open-label, randomised controlled trial. *Lancet.* 2020;396:1807-1816. doi: 10.1016/S0140-6736(20)32338-2

2. Belohlavek J, Smalcova J, Rob D, et al. Effect of intra-arrest transport, extracorporeal cardiopulmonary resuscitation, and immediate invasive assessment and treatment on functional neurologic outcome in refractory out-of-hospital cardiac arrest: a randomized clinical trial. *JAMA.* 2022;327:737-747. doi: 10.1001/jama.2022.1025

3. Lemkes JS, Janssens GN, van der Hoeven NW, et al. Coronary angiography after cardiac arrest without ST-segment elevation. *N Engl J Med.* 2019;380:1397-1407. doi: 10.1056/NEJMoa1816897

4. Desch S, Freund A, Akin I, et al. Angiography after out-of-hospital cardiac arrest without ST-segment elevation. *N Engl J Med.* 2021;385:2544-2553. doi: 10.1056/NEJMoa2101909

5. Hauw-Berlemont C, Lamhaut L, Diehl JL, et al. Emergency vs delayed coronary angiogram in survivors of out-of-hospital cardiac arrest: results of the randomized, multicentric EMERGE Trial. *JAMA Cardiol.* 2022;7:700-707. doi: 10.1001/jamacardio.2022.1416

6. Kern KB, Radsel P, Jentzer JC, et al. Randomized pilot clinical trial of early coronary angiography versus no early coronary angiography after cardiac arrest without ST-segment elevation: The PEARL Study. *Circulation.* 2020;142:2002-2012. doi: 10.1161/CIRCULATIONAHA.120.049569

7. Dankiewicz J, Cronberg T, Lilja G, et al. Hypothermia versus normothermia after out-of-hospital cardiac arrest. *N Engl J Med.* 2021;384:2283-2294. doi: 10.1056/NEJMoa2100591

8. Glauser T, Shinnar S, Gloss D, et al. Evidence-based guideline: treatment of convulsive status epilepticus in children and adults: report of the Guideline Committee of the American Epilepsy Society. *Epilepsy Curr.* 2016;16:48-61. doi: 10.5698/1535-7597-16.1.48

9. Hoyer DP, Paul A, Saner F, et al. Safely expanding the donor pool: brain dead donors with history of temporary cardiac arrest. *Liver Int.* 2015;35:1756-1763. doi: 10.1111/liv.12766

10. Mohite PN, Zych B, Sabashnikov A, et al. Effect of donor cardiac arrest and arrest duration on outcomes of lung transplantation. *Clin Transplant.* 2016;30:421-428. doi: 10.1111/ctr.12704

11. West S, Soar J, Callaway CW. The viability of transplanting organs from donors who underwent cardiopulmonary resuscitation: a systematic review. *Resuscitation.* 2016;108:27-33. doi: 10.1016/j.resuscitation.2016.07.229

12. Morris NA, Mazzeffi M, McArdle P, et al. Women receive less targeted temperature management than men following out-of-hospital cardiac arrest due to early care limitations—a study from the CARES Investigators. *Resuscitation.* 2021;169:97-104. doi: 10.1016/j.resuscitation.2021.10.036

13. Blewer AL, Schmicker RH, Morrison LJ, et al. Variation in bystander cardiopulmonary resuscitation delivery and subsequent survival from out-of-hospital cardiac arrest based on neighborhood-level ethnic characteristics. *Circulation.* 2020;141:34-41. doi: 10.1161/CIRCULATIONAHA.119.041541

14. Garcia RA, Spertus JA, Girotra S, et al. Racial and ethnic differences in bystander CPR for witnessed cardiac arrest. *N Engl J Med.* 2022;387:1569-1578. doi: 10.1056/NEJMoa2200798

15. Vogelsong MA, May T, Agarwal S, et al. Influence of sex on survival, neurologic outcomes, and neurodiagnostic testing after out-of-hospital cardiac arrest. *Resuscitation.* 2021;167:66-75. doi: 10.1016/j.resuscitation.2021.07.037